SSVEO IFA List **Date:02/27/2003**

STS - 6, OV - 99, Challenger (1) **Time:04:31:PM**

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:02	Problem	**FIAR**	**IFA** STS-6-V-01		INS
	GMT: 094:18:32		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Operational Instrumentation Failures. (ORB)

Summary: DISCUSSION: A - SSME no. 2 GH2 pressurization outlet pressure sensor (V41T1261A) failed at 153 sec MET. This transducer has failed on each flight except STS-5 and the failure has been traced to fatigue of a 0.007-inch diameter wire in the conector of the transducer. The transducer is being modified. Relocation of the transducer will be required when the redesigned GH2 flow control valve is installed. This relocation should reduce the vibration environment which is believed to be the cause of the failures.

B - SSME no. 2 GH2 presssurization outlet pressure sensor (V41P1260A) failed at 222 sec MET. This transducer failed on STS-1 and 2. The sensor was relocated for STS-3 and subsequent on OV-102 and worked successfully. The failure occurred in a 0.007-inch wire at the diaphram and was fatigue induced. The sensor has been replaced for STS-7. A new sensor is being considered for future flights. C - R OMS pod oxidizer tank total quantity (V43Q5231C) stuck at 43.4 percent during OMS-2 maneuver. This resulted in the 98-second timer not starting during the ungageable fluid region of the probe. The problem has been isolated to the tank probe electronics which would require pod removal to repair the measurement. Quantity can be determined from other sources. Fly as is. D - Hydraulic 1, 2, and 3 return line temperature responses were improper (V58T0157, V58T0159, V58T0257, V58T0359, V58T0833 and V58T0933). Inspection showed the measurements were miswired. The measurements have been rechannelized. E - Midfuselage left FES H2O feedline system A temperature (V63T1874A), zone 3, had 35-degree deadband and a 75-percent duty cycle instead of the 30-percent expected. Inspection showed excessive heater wraps. The insulation has been modified per the print. F - Right-hand aft RCS aft housing thermal switch temperature (V42T3304A) was 15 degrees lower than the redundant measurement (V42T3305A). It has been determined that the gain on the signal conditioner associated with measurement V42T3304 was low. The measurement will be fixed when it becomes convenient during a subsequent flow. G - Body flap system 1 hydraulic return line temperature (V58T0184) responded to system 2 checkout. The measurement was miswired and has been rechannelized. H - FES system B high load H2O feedline temperature (V63T1894) exceeded the upper FDA limit. The sensor is too far away from the thermostat to provide a correct reading. The sensor will be relocated effective STS-8. I - Fuel cell 2 H2 flow rate measurement (V45R0270A) failed. The problem has been isolated to the fuel cell which would require removal to fix the problem. Since the flow meter is not critical, no corrective action will be taken until such time that the fuel cell is removed and returned to the vendor. J -

External tank LO2 100-percent level sensor no. 1 (T41X1768E) failed wet. Testing at KSC has validated the Orbiter side of the interface. Similar failures occurred on STS-1 and 2. K - Fuel cell 2 H2O relief valve temperature (V45T0422) did not activate the heater at the thermostat set limit of 70? F. Heater activation did occur during ground operations at Dryden postflight. No further action required. L - Aft left FES H2O feedline system A temperature (V63T1876), zone 4, had a low duty cycle of only 4 percent. Inspection showed the wrong configuration heater was installed. The heater configuration was corrected. See problem STS-6-18. CONCLUSION: See above. CORRECTIVE_ACTION: See above. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-6-V-02	ECLSS
	GMT: 094:18:38		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Avionics Bay 1 Fan B Differential Pressure Below Fault Detection Annunciation (FDA) Limits (1.46 inches of water) (ORB)

Summary: DISCUSSION: Following MECO, the avionics bay 1 fan B differential pressure dropped to 0.3 inch of water and the current increased to 1.8 A, indicating low air flow for fan B. Fan B was turned off and fan A was used for the rest of the mission. Fan B was removed and inspected postflight at KSC. The inspection disclosed a small piece of Dacron approximately 1-3/4 inches long in the outlet check valve housing. The Dacron is suspected to be a wire bundle tie wrap. Rub marks were also discovered around the circumference of the fan inlet housing.

CONCLUSION: The piece of Dacron wire tie probably lodged between the fan housing and impeller, causing the low fan differential pressure for fan B. CORRECTIVE_ACTION: A spare fan has been installed in OV-099 to support the STS-7 mission. The fan removed from OV-099 will be evaluated at the vendor for reuse on other vehicles. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-6-V-03	RCS
	GMT: 094:18:38		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: RCS thruster R4U temperature lower then normal. (ORB)

Summary: DISCUSSION: By 00:09:30 m.e.t., the oxidizer leak detector temperature on thruster R4U had dropped to 37? F. This temperature drop indicated a probable small leak (approximately 50 cc/hr). This leak was too small to cause the leak detector temperature to drop below the RCS RM (redundancy management) leak threshold

temperature of 30? F before the thruster was again fired. The leak persisted for approximately 1.5 minutes, at which time the next firing apparently cleared the cause of the leak and the temperature rose and cycled within the heater set points. The thruster was again used at the end of the mission with no indication of leak recurrence.

CONCLUSION: The thruster had a small oxidizer leak most probably caused by contamination. When the thruster was fired the contamination was swept from the valve allowing the valve to seal. CORRECTIVE_ACTION: No corrective action is required. Fly as is. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:46	Problem	**FIAR**	**IFA** STS-6-V-04	OMS
	GMT: 094:19:16		**SPR** 06F029	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Left OMS (Orbital Maneuvering Subsystem) Failed Secondary Gimbal Check In The Pitch And Yaw Axes. (ORB)

Summary: DISCUSSION: The crew reported that during the secondary Gimbal check on the left OMS, a fail indication was noted in both the pitch and yaw axes. All of the left OMS burns were performed on the primary system. Troubleshooting isolated the problem to the controller electronics unit, which was replaced. Analysis of the failed unit showed that the driver output transistor in the pitch axis developed a hard short which opened 2 RPC's, causing both the pitch and yaw axes to issue fail flags.

CONCLUSION: The driver output transistor in the pitch axis was shorted. CORRECTIVE_ACTION: The controller was replaced. Component analysis of the driver output transistor will be tracked on CAR 06F029. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:01:42	Problem	**FIAR**	**IFA** STS-6-V-05	TPS
	GMT: 094:20:12		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: 1. The AFRSI (Advance Flexible Reusable Surface Insulation) On the OMS Pods Experienced Severe Damage on the Forward Portion And Minor Damage at Other Locations. 2. Several Tiles Just Aft Of The Nose Cap Experienced Slight Sidewall Slumping. 3. Two FRSI c (ORB)

Summary: title continued: 3. two FRSI closeout strips on the right OMS pod came loose during ascent. 4. captive gap fillers around the window closeout panels protruded during ascent.

DISCUSSION: 1. The AFRSI damage on the OMS pods varied from completely missing outer sheets and insulation to broken stitches. The severe damage on the forward portion was attributed to some type of undetermined flow phenomena. The broken threads and scuffled outer layer on the aft section was attributed to mechanical damage caused by interference with the tail cone and/or airflow turbulent effects during ferry. An on-going tunnel test program is evaluating the aerodynamic flow phenomena for assessment of the AFRSI for OV-103. Four AFRSI test panels have been added to STS-8. One panel is on the top canopy area, two on the side fuselage, and one on top of the wing. Another panel inside the orbiter payload bay will evaluate the effects of the on-orbit environment. STS-7 postflight evaluation resulted in no changes to the AFRSI on the left OMS pods for STS-8. All except 6 AFRSI blankets were replaced on the right OMS pod due to excessive water dumped during the STS-7 entry. See STS-7-27 Part 5. 2. Tile slumping was experienced on several tiles just aft of the nose cap where five tiles were removed and replaced after STS-6. There was no structural degradation and the tile gaps were filled with AB312 glass cloth. Postflight evaluation after STS-7 indicated no flow through, but minor slumping was observed on one tile aft of the nose cap. No change was required for STS-8. 3. The two FRSI loose closeout strips were noticed from on-orbit television and photography. This was not deemed serious, as missing closeout strips also occured on STS-1 and these strips were judged to be far enough aft to not result in adverse thermal effects. 4. The protruding gap fillers around the window closeout panels were noticed by the crew, and subsequent evaluation judeged this condition to result in no adverse effect during entry. CONCLUSION: 1. Replacement of the OMS pod forward AFRSI blankets on OV-099 after STS-6 with LRSI tiles per the OV-102 design resulted in no significant aerodynamic damage to the OMS pod TPS on STS-7. 2. Use of AB312 glass cloth as a tile gap filler just aft of the nose cap prevented significant tile slumping in this area on STS-7. 3. A review of documentation showed these strips were bonded at the pad with nonstandard procedures, which obviously resulted in a poor bond. 4. A review of the design requirements revealed no requirement to bond these gap fillers since they were deemed "captive". However, because of cumulative tolerances, the gaps exceeded the maximum design criteria and this permitted extrusion of the gap filler due to ascent pressure/flow gradients. CORRECTIVE_ACTION: 1. Fly OV-099 as is. Results of the wind tunnel test program will be used for assessment of the AFRSI for OV-103. AFRSI test panels on STS-8 will provide full-scale test data in four locations. 2. The one tile with minor slumping was repaired by standard repair procedures. 3. New FRSI closeout strips will be installed using standard procedures. 4. Damaged gap fillers will be replaced and bonded to the filler bar. All other gap fillers will be bonded to the filler bar. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:01:18	Problem	**FIAR**	**IFA** STS-6-V-06		C&T
	GMT: 094:19:48		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: OPS-1 Recorder Lost Tape Motion At 94:19:48. (ORB)

Summary: DISCUSSION: The OPS-1 recorder stalled and telemetry indicated no motion and bite fail during serial record mode operation on track 7 at 52 percent of tape. The condition was cleared by operating the recorder in the playback mode. Operation appeared normal until unexplained track switches started to occur at 52 percent of tape.

At 96:00:11 action was initiated to suspend OPS-1 recorder operation until re-entry and to limit operation during re-entry to 0 to 45 percent of tape to preclude additional stress on what was concluded to be a tear in the tape at 52 percent. During reentry, the tape broke at 39 percent. The entry data was not lost because it was being recorded redundantly on the OPS 2 recorder. Postflight inspection at the vendor found a small nylon tipped self locking set screw in the bottom of the recorder. The screw came from the head assembly where it was used to retain the azimuth adjustment cam. Scratches showed that the tape break which occurred during entry was caused by this screw becoming wedged between one of the three capstans and a head mounting fixture. The screw apparently jammed the recorder earlier in the mission and damaged the tape at the 52 percent position causing the end of tape sensor to trigger track switches at 52 percent. The same locking screw is used in a number of places in this and other recorders flown on previous flights with no apparent problems. The locking design has been subjected to the 100 mission qualification tests at vibration levels higher than those experienced during flight. The recorder was temporarily repaired and shipped to JSC for data dump and production of the required tape copies. CONCLUSION: A loose set screw jammed the recorder, damaged the tape and eventually caused the tape to break. This screw appears to have been seated properly at one time due to deformation of the nylon tip but may have been loosened during some rework of the head assembly. This appears to be a random workmanship problem that escaped the inspection system. CORRECTIVE_ACTION: The recorder has been replaced with a spare. The failed recorder will be repaired and returned to service. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:08	Problem	**FIAR**	**IFA** STS-6-V-07		MPS
	GMT: 094:18:38		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Right LH2 Prevalve Closed Position Indication Improper (ORB)

Summary: DISCUSSION: The SSME No. 3 LH2 prevalve (PV-6) data indicated that the visor lifted off the closer seal for one (1) minute and 53 seconds, after the snubbing pressure was removed. The propellant downstream of the closed prevalve warmed up due to the heat from the engine and the pressure increased. The pressure relieved upstream into the LH2 manifold through a relief valve and pushed the prevalve closed visor off of its seat. If the visor were pushed back about 3? of shaft rotation, the closed indication would have been lost. This is considered normal prevalve operation due to heat soak back after engine shut down.

CONCLUSION: Heat soak back after SSME No. 3 shut down increased propellant pressure and pushed the prevalve closed visor off of its seat rotating the shaft far enough to lose the closed indication. This is considered normal prevalve operation. CORRECTIVE_ACTION: None required. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Heat soak back after engine shut down may result in temporary loss of the Lh2 prevalve closed position indications while the pressure buildup relieves.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:22:56	Problem	**FIAR**	**IFA** STS-6-V-08		EPD

GMT: 095:17:26 **SPR** **UA** **Manager:**

IPR **PR**

Engineer:

Title: Humidity Separator "B" Circuit Breakers Opened. (ORB)

Summary: DISCUSSION: On-orbit at the end of day 1, the humidity separator "B" ac motor circuit breakers tripped on all three phases. Also, the humidity separator single-phase ac signal conditioner circuit breaker tripped at approximately the same time. Ac bus 2 and 3 voltage and current data indicated a possible wire harness short in the ECLSS bay near the humidity separator "B" package. The crew used the humidity separator "A" package throughout the rest of the mission. Postflight inspection in the ECLSS bay disclosed that all six conductors had melted through in the humidity separator "B" wire harness. There was evidence of arcing between the damaged wires in the harness but no evidence of arcing to structure. The insulation on the six wires was burned and the protective Teflon wrap of the wire harness was discolored. The humidity separator and the signal conditioner receive power through this same wire harness. Evaluation of the burnt wires and the insulation did show evidence of wire damage; however, the source of the damage, as well as when the damage occurred, could not be ascertained.

Tests have shown that with insulation and conductor damage, wire-to-wire arcing could occur and result in damage similar to that which occurred during the STS-6 flight. Due to the concern of the effect of multiple ac bus transients occurring during other flight phases, an extensive review has been conducted to (1) identify the ac loads that could be turned off during ascent, (2) assess the criticality and sensitivity of ac loads to multiple bus transients, and (3) reexamine the vehicle wire routing where two or more ac busses are routed in the same wire harness. The review has resulted in identification of 6 ac functions which will be turned off during ascent for STS-7 and subsequent. Two critical ac devices - the SSME controller and the proximity sensor electronics assembly - have been identified as sensitive to multiple bus transients. Tests completed on an SSME controller show that the controller is susceptible to single-phase and three-phase transients before the circuit breaker would open. The three-phase transient experienced on STS-6 exceeded the MEC ICD 95 Vrms threshold for switchover. Therefore the controller would have switched from the A to B side because of the three-phase voltage spike. The threshold at which a single-phase transient could trip the controller was determined by test to be 85 Vrms. The STS-6 flight data showed that the single-phase voltage decreased to about 90 Vrms. This indicates that for the specific short experienced, the controller would have switched from the A to the B side because of the three-phase voltage spike and the B side of the controller could have stayed on-line with the single-phase transient. The Orbiter proximity sensor electronics for weight on the main and nose wheels are also susceptible to ac bus voltage transients. One main gear sensor and one of two nose gear sensors are powered by ac bus 2 phase A and the two other corresponding sensors by ac bus 3 phase A. If both Weight-On-Wheels (WOW) and both Weight-On-Nose Gear (WONG) discretes are set after the PGNS transition to autoland at about 85 seconds prior to touchdown, the flight control system will be reconfigured. After both WOW discretes are true for about 1 second the HUD is reconfigured, the speed brake goes to full open, turn coordination becomes open loop, pitch-angle commands are a function of airspeed and displays are changed; but the Orbiter can be flown in CSS mode provided that the pitch and roll/yaw are operated manually. After all 4 WOW and WONG discretes are true for about 3 seconds, the pitch-rate feedback loop will be open and the elevons will be set to 10? in auto; in CSS the elevons go to zero and up to +/- 18? of elevon can be commanded with additional trim provided by manual speed brake operation. The orbiter can be flown marginally in the CSS mode when the flight control

system reconfigures after WONG occurs. Tests completed on the proximity sensor electronics indicate that the threshold to set the WOW and WONG discretes is 65 Vrms. This equates to an 18 to 19 amp short which should activate its circuit breaker in less than 2 seconds and prevent WONG from occurring. CONCLUSION: Severe wire damage to a bundle near the humidity separator in the ECLSS bay tripped four ac circuit breakers. The actual cause of the wire bundle damage cannot be determined; however, the problem most probably resulted from gross damage to the wire harness prior to launch. This damage degraded with time because of localized heating affects and also was possibly aggravated by launch vibration. CORRECTIVE_ACTION: The damaged wire has been removed and replaced and a successful functional test completed. To minimize the risk during ascent on STS-7 and subsequent flights, the following circuits will be opened: (1) humidity separator signal conditioner, (2) IMU fan signal conditioner, (3) cabin temperature controller No. 1, (4) cabin temperature controller No. 2, (5) Freon flow prop 1 and (6) Freon flow prop 2. Transient voltage sensitivity testing of the SSME controller and the Orbiter proximity sensor electronics has been completed. Wire harness-to-locker clearances in the ECLSS bay have been improved by moving the wire harnesses, where necessary. Closeout inspection will be intensified in areas where the wire harnesses are covered by a protective Teflon wrap. OV-102, 103 and 104 will be inspected with emphasis in areas where wire damage history exists and clearances will be improved as necessary. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-09	C&T
	GMT: 094:22:44		**SPR** 06F021	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: On-board Control Of The TV Camera Zoom Capability Was Intermittently Inoperative. (ORB)

Summary: DISCUSSION: The crew reported that the TV cameras were not responding to "zoom out" commands from the A2 panel, but did respond to ground commands. This onboard capability was recovered after "jiggling" the switch.

The anomaly recurred several times during the first day, but the crew was able to recover control each time after jiggling the switch. The problem could not be duplicated at KSC even by moving the wires behind the panel. An intermittent failure in the switch is the most probable cause of the loss of on-board TV camera zoom-out capability. However, the RCU (remote control unit) may have been at fault and jiggling the switch could have allowed the intermittent fault time to correct itself. The switch was removed and replaced. Failure analysis at the prime contractor of the solder connectors and conformal coating together with x-rays and functional testing did not identify a cause for the intermittent problem. Functional testing of the RCU postflight in the orbiter with both the STS-6 and the replacement switch confirmed proper system and RCU operation. CONCLUSION: The most likely cause of the loss of on-board TV camera zoom out capability was a intermittent switch failure. An intermittent fault in the RCU was also a possibility. Failure analysis on board the orbiter and at the prime contractor has been unable to identify the cause for the intermittent failure. CORRECTIVE_ACTION: KSC has removed the switch leaving the solder connections and conformal coating intact with the switch to facilitate analysis. A new switch was installed. The removed switch was returned to the prime contractor. Failure analysis continuing and will be tracked on CAR (Corrective Action Report) 06F021. CAR ANALYSIS: Analysis has failed to disclose any discrepancy that could account for the reported failure. Since there is no confirmed failure,

there will be no corrective action. Two unrelated failures were found in the camera Remote Control Unit (RCU) and it was felt that the RCU was the source of the problem. This is a GFE item, as is the RCU. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:10:39	Problem	**FIAR**	**IFA** STS-6-V-10	STR
	GMT: 095:05:09		**SPR** 06F015	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Airlock Inner Hatch "O" Ring Pulled Out Of Seal Groove. (ORB)

Summary: DISCUSSION: When the crew first opened airlock hatch "A" (the inner hatch), they reported that a short length of "O" ring seal came out of its restraining groove in the airlock structure. The crew reinstalled the seal and hatch worked properly for the remainder of the mission. This hatch seal is redundant, i.e., there are 2 seals in adjacent dovetail shaped restraining grooves, each with an "O" ring.

Postflight, the "O" ring seal diameter was found to be slightly undersize and the width of the restraining groove was found to be oversize. CONCLUSION: The seal came out of its restraining groove because it was slightly undersize and the groove was slightly oversized. The seal functioned properly when replaced in its groove. CORRECTIVE_ACTION: For STS-7, the restraining groove width will be reduced by the use of aluminum tape and both "O" ring seals on hatch "A" have been replaced with seals on the high side of the seal tolerance. Both the "A" and "B" hatches of the airlock have been leak checked. Other methods of restraining the seals are under investigation. This problem will be tracked on CAR 06F015. CAR ANALYSIS: MCR 10321 authorized revision to orbiter hatch "O" ring seal installation drawings. The revised installation, maintenance and removal of adhesive bonded "O" ring seals specification (MAO106-328, Rev. H) will preclude future occurrances of airlock hatch seals coming out of seal grooves. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:20:48	Problem	**FIAR**	**IFA** STS-6-V-11	ECLSS
	GMT: 095:15:18		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: High Oxygen and Nitrogen Flow on PCS 1 and PCS 2. (ORB)

Summary: DISCUSSION: High oxygen flow in excess of 5 lb/hr occurred on PCS 1. High oxygen flow and two cases of nitrogen flow in excess of 5 lb/hr occurred during operation on PCS 2. These high flow conditions resulted in master alarms and Fault Detection Annunciation (FDA) messages and required manual operation of the

Atmospheric Revitalization Pressure Control Subsystem (ARPCS). The manual control operation of the ARPCS was satisfactory in controlling the cabin total pressure and PP02 (oxygen partial pressure) within acceptable limits.

CONCLUSION: The high oxygen and nitrogen (flow alarms) were caused by the improper operation of the cabin pressure regulator. CORRECTIVE_ACTION: The OV-099 oxygen/nitrogen control panel has been removed and replaced with the OV-103 control panel for STS-7. The OV-099 control panel has been sent to JSC for evaluation tests and the panel will then be sent to the vendor for additional testing and disassembly investigation. Final corrective action is pending the results of the JSC and vendor tests. EFFECTS_ON_SUBSEQUENT_MISSIONS: None. Manual ARPCS control procedures can be implemented if the high oxygen and nitrogen flow conditions recur.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** -002:00:55	Problem	**FIAR**	**IFA** STS-6-V-12	DPS
	GMT: 092:19:25		**SPR** AC5458	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: PCMMU 2 BITE Bit 10 Toggled Indicating Input Data Invalid Conditions Were Occurring Prelaunch. (ORB)

Summary: DISCUSSION: PCMMU bite bit 10 errors indicate that the PCMMU is receiving some input data that are invalid. This condition was present when PCMMU 2 was powered up There were no errors when PCMMU 1 was powered up. After switching back to PCMMU 2 for troubleshooting, PCMMU 2 was operated for 18 hours with no further bite bits set. A data analysis isolated the cause to MDM OF2 (S/N 91). MDM OF bite bits 3 and 4 were toggling simultaneously with that of PCMMU 2 bite bit 10. The nominal operation of the MDM is to set the data validation bit (in data words sent to the PCMMU) to the invalid state and to set the appropriate bite bit when an MDM detects the error conditions of bits 3 or 4. The PCMMU was correctly flagging invalid data. MDM OF2 has been removed and replaced. S/N 91 was returned to the subcontractor for troubleshooting and will be tracked via CAR AC5458. This anomaly is not considered an MDM generic problem

CONCLUSION: The anomaly was due to a failure in MDM OF2 and is not considered an MDM generic failure. CORRECTIVE_ACTION: The suspect MDM has been returned to the vendor for analysis. A replacement MDM has been installed and checked out. The suspect unit will be tracked by CAR AC5458. CAR ANALYSIS: Flight failure has been isolated to Module p/n 4020107-903, slot XA22, Hybrid p/n 4031457, SCU output bus. The Hybrid proved to be defective at high temperatures. No other failures of this nature have been reported and no corrective action will be taken. [not included in original problem report]
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:00:00	Problem	**FIAR**	**IFA** STS-6-V-13	APU
	GMT: 096:18:30		**SPR** 06F010	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: APU 1, 2 and 3 Seal Cavity Drain Leaks. (ORB)

Summary: DISCUSSION: Although all 3 APU seal cavity drains leaked during the flight, no leak was large enough to cause any concern for APU operation. Flight data indicated that APU 3 seal cavity drain pressure dropped to two psia while APU 2 fell to 1 psia.

Postflight, all 3 drain relief valves were leak checked. Only the APU 3 valve was found to be leaking and it also showed an increased cracking pressure. The leak in APU 1 was so small (pressure dropped from 15 to 11 psia in 5 days) that further leak checking was not considered necessary. The APU 2 leak was found to be a leaking pressure transducer O-ring seal. Should small leaks re-occur, it would not be harmful to the operation of the APU. However, if the seal cavity drain pressure leaks to 0 psia and a major fuel leak occurs, freezing and blocking of the drain line is possible. CONCLUSION: The small leak in APU 1 is acceptable for flight on STS-7. The cause of the relief valve leak on APU 3 and the transducer seal leak on APU 2 awaits failure analysis. CORRECTIVE_ACTION: The APU 3 relief valve has been replaced and the leaking pressure transducer seal on APU 2 has had an O-ring replaced. The systems have been flushed and leak checked. This problem will be tracked on CAR 06F010. CAR ANALYSIS: Valve cracking pressure was observed to range between 17 and 31 psig during failure analysis at RI/DNY L&T. The valve was then disassembled and examined. It was noted that the bellows evacuation hole, which is electron beam welded shut, had a weld bead which was recessed into the parent material. This results in improper mating contact between the bellows assembly and the poppet. Unequal contact forces between the poppet and the seat could result in and cause a cocked condition resulting in erratic cracking pressures experienced during testing. An ECP was proposed to NASA (to relocate the evacuation hole) and was rejected. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 001:08:48	Problem	**FIAR**	**IFA** STS-6-V-14	CREW
	GMT: 096:03:18		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Four EMU Light Batteries Did Not Work. (ORB)

Summary: DISCUSSION: Four of twelve EMU light batteries failed to power the lights during EVA preparations on STS-6. Postflight ground tests of the flight batteries indicate that voltage delay due to passivation of the lithium anodes when coupled with characteristics of the switch circuit on the lights caused the battery power to turn off

before the battery could bootstrap to the normal load voltage. This passivation, although normal, is a function of time and temperature of storage.

Due to the STS-6 flight delays these batteries had been exposed to room temperature for the four months before launch. Room temperature exposure will be limited to two months before launch on future flights. For STS-7 through STS-10, only contingency EVA capability is required; thus, only 4 of 12 cells are required to function. CONCLUSION: The four-month room temperature exposure period for these batteries due to flight delays was excessive for this application. CORRECTIVE_ACTION: For STS-7 through STS-10, the room temperature exposure time will be minimized. The target time period is 21 days. If flight delays cause the time period to exceed two months, the batteries will be replaced. For STS-11 and subsequent flights, the onboard battery conditioner will be redesigned and utilize to condition batteries (remove passivation). Quantitative determination of the passivation build-up rate will be determined through the Li-BCX "D" cell shelf life program. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-15	RCS
	GMT: 96:15:55		**SPR** 06F009	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Left Aft RCS Thruster L2D Fuel Leak. (ORB)

Summary: DISCUSSION: Thruster L2D was deselected by the RCS RM (Redundancy Management) at 96:15:55 G.m.t. because of an indicated fuel leak. The leak apparently stopped and the thruster was reselected and hot-fired. However, the leak recurred at 98:03:12 G.m.t. and the thruster was deselected again. It was left deselected for the remainder of the mission.

CONCLUSION: The thruster has a fuel leak most probably caused by contamination. CORRECTIVE_ACTION: The thruster was removed and replaced. It will be returned to the vendor for failure analysis and tracked on CAR (Corrective Action Report) 06F009. CAR ANALYSIS: Analysis confirmed that contamination caused the leak. More stingent cleanliness standards have been imposed. No further action will be taken. Close this CAR. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 000:00:10	Problem	**FIAR**	**IFA** STS-6-V-17	MPS
	GMT: 094:18:40		**SPR**	**UA**	**Manager:**

IPR **PR**

Engineer:

Title: SSME No. 1 GH2 Flow Control Valve Hung Up. (ORB)

Summary: DISCUSSION: Engine no. 1 GH2 pressurization Flow Control Valve (FCV) intermittently failed to open completely during STS-6 operations. Engine no. 1 GH2 pressurization outlet pressure (V41P1160A) measurements indicate that the engine 1 FCV failed to open completely on three separate occasions in the first 110 seconds of the flight. The valve did respond to the open commands but "hung up" between the full closed and open positions. These failures only occurred at the flow and pressure conditions of 104 percent flow and were probably due to a marginal pneumatic balance condition at this flow rate. Similar intermittent failures were observed for the GO2 FCV's on STS-1 and STS-5, although this is the first such failure on the GH2 FCV's. No other FCV failures were observed on STS-6 after 110 seconds to the end of the flight.

During ATP the failed valve exhibited a higher susceptibility for the pneumatic balance problem than the other two GH2 bypass valves flown on OV-099. Increasing the GH2 FCV spring force from 35 lbf to 45 lbf on the present FCV design should resolve the marginal pneumatic condition at the 104 percent flow rate. The GH2 FCV configuration has been redesigned for 109 percent flow operations without the potential pneumatic balance problems seen in the present by-pass valve design. This redesigned valve configuration has essentially completed qualification testing and has been installed in OV-103. Retrofit will be required for OV-099 prior to 109 percent operations. Retrofit with redesigned valves will require approximately 27 shifts. CONCLUSION: The present GH2 by-pass flow control valve design has a marginal pneumatic balance condition at the 104 percent flow rate. A redesigned GH2 FCV configuration eliminates this failure mode as demonstrated in qual testing at 109 percent flow conditions. CORRECTIVE_ACTION: The failed GH2 flow control valve will be replaced for STS-7 by a spare valve of the present design with an uprated 45 lbf spring force. All the GH2 bypass valves on OV-099 will be replaced as soon as pratical with valves redesigned for 109 percent operation. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:13:03	Problem	**FIAR**	**IFA** STS-6-V-18	HYD
	GMT: 097:07:33		**SPR** 06F028	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Aft Right FES H20 Feedline System B Temperature (V63T1877), Zone 4, Indicated A Decay Rate Of About 20 Deg/Hr. (ORB)

Summary: DISCUSSION: During the on-orbit phase the aft right FES feedline B temperature, V63T1877, Zone 4 indicated a rapid decay of approximately 20 deg/hr. In addition, the left Zone 4 heater operated at an unexpectedly low duty cycle of 4 percent. Postflight evaluation and inspection showed the right feedline B heater thermostat

had failed "open". In addition, it was found that the right and left heaters had been switched during installation. These heaters are of different wattage and length. This accounts for the low duty cycle exhibited by the left Zone 4 heater.

The failed thermostat will be removed, replaced and sent to the vendor for failure analysis. This thermostat was part of a lot with potential contamination from small fibers but was considered acceptable for flight on STS-6. The right and left FES feedline, Zone 4, heaters will be reinstalled as per print. CONCLUSION: The rapid temperature decay rate resulted from a failed off thermostat. The low heater duty cycle was caused by improper heater installation. CORRECTIVE_ACTION: Prior to STS-7 the right and left FES feedline, Zone 4, heaters will be reinstalled for proper configuration and the right feedline B thermostat will be replaced. Failure analysis of the thermostat will be tracked on CAR 06F028. CAR ANAYSIS: This problem is explained closed using rationale as follows: A. This switch failure appears to be a random failure. B. 74 are used on OV-102; 53 are used on OV-099, OV-103 and OV-104. C. All thermal switches are criticality 3. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 002:01:30	Problem	**FIAR**	**IFA** STS-6-V-19	D&C
	GMT: 096:20:00		**SPR** 06F018	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The Pilots HSI (Horizontal Situation Indicator) Primary Miles Counter Failed OPS 8 Dedicated Displays Checkout Tests On-Orbit. (ORB)

Summary: DISCUSSION: During the OPS 8 FCS checkout, the crew reported that the hundreds digit of the HSI Primary Miles Counter failed to go to the "Flag" position during the flag test, or after power was turned off. The thousands digit was also reported as not reading properly during descent.

Tests at KSC have failed to duplicate the problem. The HSI appears to be working properly. The primary miles information is displayed redundantly on the other HSI and for STS-7 on the HUD (Heads Up Display). CONCLUSION: The failure is intermittent and its cause is unknown until failure analysis is complete. CORRECTIVE_ACTION: The HSI (Horizontal Situation Indicator) has been replaced with a spare unit. It will be returned to the vendor for failure analysis and tracked on CAR 06F018. CAR ANALYSIS: The failure mode was duplicated only when the input voltage to the wheel was at the low limit. When any eleven position mag wheel is commanded to rotate three positions, the available torque to drive the wheel is minimal (an inherent characteristic of the design). The silicon oil used to lubricate the friction disc can migrate resulting in slightly increased friction levels. This, in combination with reduced torque, may cause the wheels to stick when commanded to move three positions. Other commands are OK due to increased torque available. Friction damping mag wheels are no longer manufactured. An improved wheel is now being used. It uses a combination of viscous and magnetic damping. The new mag wheel is directly interchangeable and is considered equal or better than the old design. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:00	Problem	**FIAR**	**IFA** STS-6-V-20		GND
	GMT: 094:18:30		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: T-0 Umbilical Damage. (ORB)

Summary: DISCUSSION: A postlaunch inspection of the ground side of the T-0 umbilical showed that the J-55 connector saver was still attached to the umbilical and the Freon QD (Quick Disconnect) was damaged.

Postflight servicing of the Freon coolant loop was successfully accomplished, indicating that the flight half of the Freon QD was not damaged. It has been determined that the Freon QD was not properly aligned during mating. One of the connector locking pins on the Orbiter side of the J-55 connector was sheared off. The J-55 connector saver was installed in a cocked position that resulted in the saver being attached on only one of the three locking pins. CONCLUSION: The Freon QD was not properly aligned at mating. The J-55 connector saver was improperly installed. CORRECTIVE_ACTION: The Freon QD will require visual monitoring for proper alignment during installation. Instructions have been provided to ground crews on the proper mating procedure for the J-55 connector saver. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 003:02:00	Problem	**FIAR**	**IFA** STS-6-V-21		C&T
	GMT: 097:20:30		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: MCC Received An Echo Of Uplink Voice During EVA Preparations And During EVA. (ORB)

Summary: DISCUSSION: The echo occurred when the UHF transceiver was keyed on while the EMU's were also transmitting. The problem could not be reproduced post-EVA when the EMU's were off. The echo had been encountered during preflight checkout at KSC but it was not considered objectionable for EVA operations on STS-6. Turnaround of UHF modulation was duplicated on one transceiver at vendor's plant. The turnaround occurred due to an intermodulation between the 296.8 MHz transmitted signal and a 259.7 MHz received signal. All other transceivers were screened for intermodulation, but no others were affected.

CONCLUSION: The echo is due to turnaround of the uplink modulation in the UHF transceiver because of intermodulation. The problem occurs only in duplex operation (EVA Mode). There is no effect on simplex air-ground communications or on reliability. CORRECTIVE_ACTION: The UHF transceiver on OV-099 will be replaced as a target of opportunity prior to STS-8. All other flight transceivers have been screened for intermodulation. EFFECTS_ON_SUBSEQUENT_MISSIONS: None for air-ground UHF communications. The echo will recur during EVA on OV-099 until the UHF transceiver is replaced.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 000:00:01	Problem	**FIAR**	**IFA** STS-6-V-22		STR
	GMT: 094:18:31		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Clevis Bracket For Closed Circuit Television Monitor Debond From The Crew Cabin Sidewall. (ORB)

Summary: DISCUSSION: The clevis became debonded at approximately 60 seconds into the flight of STS-6. Investigation into the problem after landing resulted in the following findings:

a. This is the same configuration that flew on OV-102 for 5 flights with no problems. b. Visual inspection of the bond revealed approximately 30 percent void and the other 70 percent possibly substandard. c. Clevis was mislocated approximately 1/2" too far forward and 1/2" too far outboard. The mislocation probably caused excessive loading of the bond joint. CONCLUSION: The clevis was not bonded properly and was mislocated. CORRECTIVE_ACTION: The clevis will be installed properly per drawing for STS-7. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 003:22:36	Problem	**FIAR**	**IFA** STS-6-V-23		C&T
	GMT: 098:17:06		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Wireless Crew Communications Units (WCCU's) A Set Inoperative, B Set Noisy. (ORB)
<u>Summary:</U>DISCUSSION: The pilot reported on the morning of day 5 that he had been using the A set of WCCU's when it went completely dead. A battery changeout in the leg unit did not correct the problem so he deployed the B set. This set exhibited excessive noise which the rest of the crew heard. The pilot then deployed the C set which worked satisfactorily for the rest of the mission.

When returned, the WCCU's were functionally checked as sets but the reported problems could not be reproduced. All batteries were checked and three were found with blown fuses. All WCCU's passed the normal acceptance test procedure. All WCCU's were visually inspected and no problems identified. The A set was subjected to a 3 axis, 10 minute/axis vibration test with no problem. The B set exhibited noise only by removing the leg unit antenna. The antenna connector on that unit was found to have slightly damaged threads. CONCLUSION: A set - Probably an internal short which blew the battery fuse which was cleared by handling in the return flow. B set - Possible intermittent or poorly connected antenna or some other internal intermittent failure. CORRECTIVE_ACTION: Fly different units for STS-7. Continue testing this hardware to establish definite failure. Investigate improving antenna connector for future missions. Additional spares are being flown on STS-7. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:09:17	Problem	**FIAR**	**IFA** STS-6-V-24	DPS
	GMT: 099:03:47		**SPR** 06F025	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: GPC-2 Fail Indication. (ORB)

Summary: DISCUSSION: At 99:03:47 G.m.t., the crew reported receiving a failed no. 2 General Purpose Computer (GPC-2) caution and warning alarm. GPC-1 and 2 were loaded with the on-orbit GN and C software and GPC-4 was loaded with the systems management software. Analysis of the GPC-1 and 2 dumps showed:

a) GPC-2 did not go through sync fail, thereby indicating it stopped executing instructions. b) The sync trace in the executing GPC (-1) stopped at a time very close to the time the failed GPC stopped executing instructions (GPC-2 stopped and GPC-1 failed it out of the set at the next sync point). c) GPC-2 did not accept the voter fail latch interrupt associated with the sync fail. d) The program counter 1 and program counter 2 clocks in GPC-2 stopped at reasonable values. Since the redundant set redundancy management would protect the system should the problem have recurred, GPC-2 was placed on line for entry. No problems were encountered. CONCLUSION: The probable cause for the GPC-2 caution and warning alarm is a transient failure in the CPU timing electronics. CORRECTIVE_ACTION: GPC -2 has been removed and returned to the vendor for analysis. This problem will be tracked on CAR 06F025. CAR ANALYSIS: The failure was isolated to a defective Delay Line (PN 6086008-1, LDC 7893), installed on Memory Timing Page (PN 6247008-31, S/N 61). Delay Line failure analysis showed that a wire wrap was not accomplished prior to soldering and that the wire had pulled from the solder. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** 004:18:12	Problem	**FIAR**	**IFA** STS-6-V-25	GFE
	GMT: 099:12:42		**SPR**	**UA**	**Manager:**
			IPR	**PR**	

Engineer:

Title: Teleprinter Failed To Return To Low Power Standby Mode After Completion Of Message Transmission. (ORB)

Summary: DISCUSSION: The teleprinter has two power modes. The high power mode is used for normal operations and includes self test. The low power mode is used to maintain operating temperatures during standby. When the paper feed button is actuated the unit goes to high power mode until operation is completed then automatically goes to the low power mode. When the unit is in the self test mode the high power mode will be in effect until the self test steps are manually executed or until the unit input power is cycled "off" then "on". During STS-6 the unit did not return to the low power mode following a paper feed operation but rather went into self test and thus remained in the high power mode.

Postflight the problem was isolated in the laboratory to the multilayer printed circuit mother board and a daughter board due to a crosstalk condition between signals associated with the paper feed and the self test switches. Testing of 3 mother boards and 5 daughter boards determined that the printed circuit mother and daughter boards from the telelprinter flown on STS-6 were unusually susceptible to noise pulses. The crosstalk condition will be eliminated by isolating the test switch from the paper feed switch. The ground will be removed from the self test switch to the paper feed switch. The self test switch will then be grounded to the motor drive board on the control panel. The teleprinter on OV-099 for STS-7 has flown without a problem for the first five flights on OV-102. CONCLUSION: Multilayer printed circuit mother and daughter boards on the teleprinter control panel were found to be unusually susceptible to noise pulses due to a crosstalk condition between signals associated with the paper feed and the self test switches. CORRECTIVE_ACTION: The STS-6 teleprinter was removed and replaced by the teleprinter flown successfully on STS-1 through STS-5. The crosstalk condition will be eliminated on all teleprinters flown after STS-7 by a retrofit changing the grounding scheme. Component failure analysis will be tracked by FIAR JSC NR EE-0556. FIAR ANALYSIS: Analysis revealed a cold solder joint in a ground wire to a switch which allowed continued high power operation and crosstalk. A change to the internal grounding system is planned for future flights. [not included in original problem report]
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-26		MPS
	GMT:		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Increase In Engine No. 3 Leg A Helium Regulator Outlet Pressure. (ORB)

Summary: DISCUSSION: During the SSME hydraulic repressurization procedure, the helium isolation valves of supply leg B of engines 1 and 3 were opened for approximately 30 seconds. After this procedure was completed just before the deorbit maneuver, it was observed that the regulator outlet pressure may have been caused by a leaking leg A regulator outlet check vavle or a leaking leg A helium supply isolation valve. The leak rate has been calculated to be approximately 20 scims. A leak of

this magnitude is not detrimental to MPS performance.

CONCLUSION: The SSME 3 helium pressure increase was caused by leakage of the isolation valve or check valve and was not of sufficient magnitude to be detrimental to MPS performance. CORRECTIVE_ACTION: None. The leak rate will continue to be monitored. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-6-V-27		DPS
	GMT:		SPR	UA		Manager:
			IPR	PR		
						Engineer:

Title: Landing Gear Isolation Valve On System 2 Did Not Activate. (ORB)

Summary: DISCUSSION: During entry, the landing gear isolation valve on system 2 did not open as programmed. The crew manually operated the valve and the rest of the system performed normally. The software provides commands to each of the 3 valves at 19,000 ft/sec for system 3, 6 minutes 35 seconds later for system 2 and a 13 minutes late for system 1. Verification of these software functions has been performed both analytically and in SAIL and software has been discounted as a problem source.

Tests at KSC consisting of inputting the open command through the keyboard have verified the command link through the MDM to the isolation valve. A prelaunch problem with the isolation valve was attributed to air in the system which resulted in sluggish valve operation. Because the valve operated briskly during the ground retest and again when operated manually during flight, this is not considered a likely cause. The MDM or downstream cabling/electronics must be considered as likely causes. Such intermittencies have occurred previously in MDM discrete output channels Experience indicates an extremely low repetition rate even during special retest by the vendor. The existing capability for manual activation of the valve precludes any mandatory requirement for further fault isolation. CONCLUSION: The problem could not be repeated during ground testings. A transient MDM failure is considered to be the most likely cause of the problem. CORRECTIVE_ACTION: The crew will be alerted to the possibility of manually operating the isolation valve. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-6-V-28		HYD
	GMT:		SPR 06F001	UA		Manager:
			IPR	PR		

Engineer:

Title: Hydraulic Bootstrap Pressures Decayed Prelaunch And System 2 Pressure Decayed On-orbit. (ORB)

Summary: DISCUSSION: All 3 hydraulic systems bootstrap pressures decayed sporadically during prelaunch operations. The pressures were adjusted to an acceptable level for the mission by operation of the circulation pumps.

On orbit, system 2 hydraulic pressure decayed and postflight it was determined that a gas leak had occurred in the system 2 accumulator. The accumulator was returned to the vendor for failure analysis. Tests could not repeat the leak; however, when the unit was disassembled, seal damage to both oil and gas seals was noted. The seal damage has been attributed to a bad seal cure during the manufacturing process. Testing to determine the cause of the prelaunch bootstrap pressure losses is continuing. CONCLUSION: The on-orbit pressure decay in hydraulic system 2 was due to an accumulator gas leak most probably caused by a faulty accumulator seal. The prelaunch bootstrap pressure decay is not yet understood, but can be procedurally controlled to be acceptable for STS-7. CORRECTIVE_ACTION: The system 2 accumulator has been replaced. The OMRSD procedures have been changed for STS-7 to simplify the maintenance of bootstrap pressure. Testing to determine the cause of the pre-launch bootstrap pressure loss will continue. This problem will be tracked on CAR 06F001. CAR ANALYSIS: Testing to determine the cause of system 2 bootstrap pressure loss isolated the cause to defective accumulator gas seals. The seals were replaced and the accumulator has been successfully returned to service. Sporadic pre-launch multi-system bootstrap pressure decay has been attributed to contamination (silting) in the unloader valve allowing fluid leakage resulting in greater ullage volume. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-6-V-29	FCP
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	

Engineer:

Title: During Postflight Checkout After STS-6, The Fuel Cell Powerplant (FCP) No. 1 Coolant Pump Delta Pressure Measurement And Talkback Remained On After FCP 1 Shutdown. (ORB)

Summary: DISCUSSION: Troubleshooting at KSC isolated the failure to the FCP coolant pump delta pressure switch. The switch contacts (both sets) were verified closed. They should have been open. Comparison of dielectric strength test results prior to delivery and after failure verified the switch was operating successfully at delivery.

The delta-P switch was returned to the vendor for failure analysis which revealed the hermetic switch assembly contained FC40 coolant. The Inconel X bracket to 321 stainless steel case weldment was defective and provided the leak path. Examination of the weld indicated shrinkage cracking caused by excessive heating (multiple passes) at the time of weld as the mechanism which initiated the failure. FC40 is an excellent dielectric and, as such, does not affect the operating characteristics of the switch; however, the failure was realized when sufficient FC40 in the switch cavity expanded (due to thermal activity during FCP operation) to deform the internal details to the extent that the contacts remained closed. The failure was repeated by pressurizing the switch to 800 - 900 psi to simulate thermal expansion of trapped FC40 coolant. The test results agreed with pretest analysis. The switch's final leak test was performed prior to the weld operation. CONCLUSION: The failure was due to leakage of FC40 coolant into the hermetic switch assembly (through a defective weld) and subsequent thermal expansion of FC40 causing switch deformation. CORRECTIVE_ACTION: The failed unit on OV-099 has been replaced with a new switch which was verified to be working properly. FCP's 2 and 3 on OV-099 are acceptable for use as is for the remaining two-substack FCP flights. Prior flight verification is adequate for the subsequent flight. The new three-substack fuel cells for OV-102 are being returned to the vendor for delta-P switch changeout. Eight of 29 delta-P switches have been leak checked after this failure with no problems and 180,000 units of similar design are in service with no reported problems. The delta-P switch acceptance test procedures (ATP) are being updated to perform the leak check after the bracket-to-case weld operation. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** 002:09:00	Problem	**FIAR**	**IFA** STS-6-V-30		ECLSS
	GMT: 097:03:30		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: ARPCS Oxygen Regulators Leaking. (ORB)

Summary: DISCUSSION: Internal leakage in the 02/N2 control panel downstream of the 100 psig oxygen regulator was indicated by the increase in system 1 and 2 oxygen regulator outlet pressure during periods when the systems were inactive. This condition required raising the FDA limits during the flight to prevent nuisance alarms. The leakage in both systems (less than 10 sccm) could be stopped by closing the respective oxygen regulator inlet valve.

CONCLUSION: The leakage in both systems is minor and can be controlled by manual isolation of the oxygen regulator inlet valve. The FDA limits can be raised to prevent nuisance alarms. CORRECTIVE_ACTION: The OV-099 O2/N2 control panel will be returned to the vendor for evaluation of anomaly STS-6-11. The leakage in the O2 regulators will also be evaluated during the vendor tests. The OV-103 panel will be installed in OV-099 to support STS-7. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-31		STR

GMT:	**SPR**	**UA**	**Manager:**
	IPR	**PR**	
			Engineer:

Title: Doors for the Waste Collection System, Avionics Bay 3B and the Middeck Audio Panel would not close. Crew reported the locker doors would not close properly. (ORB)

Summary: DISCUSSION: A. The waste management compartment and the avionics bay 3B doors could not be locked on orbit, but could be locked after landing.

B. One of the two retention bolts on the middeck audio panel could not be installed after removal for inflight maintenance. Inspection revealed the design did not allow for vehicle flexure because the nut plates did not float and the hole tolerance was tight. C. A number of lockers could not be locked on orbit. Inspection of the locker revealed that a small deflection of the locker (racking) would cause misalignment of the lock resulting in cross-threading of the screw. Further inspection of the vehicle revealed an improper installation of the seal strip on the thermal/debris panels behind some of the lockers resulting in the seal strip being wedged between the locker and the wire tray. The seal strip wedged under one corner of the locker would cause racking and misalignment. The wing nuts on some of the lockers were found to be improperly installed and some had defective threads. Cabin deflections are expected. However, data from strain instruments during pressure tests demonstrasted that structural integrity is not an issue. CONCLUSION: The basic cause of the door problems is attributed to cabin deflections which have increased as a result of the weight reduction program accomplished after OV-102. CORRECTIVE_ACTION: No hardware fixes are to be incorporated for STS-8. Data will be obtained during the next 3 flights of OV-099 and 103 to provide a data base for development of fixes. Corrective action will be tracked on Flight Test Problem Report STS-7-33. EFFECTS_ON_SUBSEQUENT_MISSIONS: Fixes will be developed for OV-099, 103 and 104 after flight data are obtained.

Tracking No	**Time**	**Classification**		**Documentation**		**Subsystem**
MER - 0	**MET:**	Problem	**FIAR**		**IFA** STS-6-V-32	C&T
	GMT:		**SPR**		**UA**	**Manager:**
			IPR		**PR**	
						Engineer:

Title: Pictures Fuzzy On Both TV Monitors (ORB)

Summary: DISCUSSION: The crew reported degraded contrast and fuzzy pictures on both TV monitors during the mission. The two TV monitors were removed from their flight deck bracket and stowed on the middeck for re-entry due to a bonded bracket breaking loose from the cabin wall--apparently during launch. These monitors were returned to JSC for analysis of their condition in consideration of their use for STS-7. The above stated problem was subsequently voiced by the crew during debriefings.

A thorough performance evaluation was performed and the results indicated that both monitors were well within specification limits. No video inputs displayed on either monitor (test pattern and TV camera inputs) appeared "fuzzy." There was no difficulty in adjusting either monitor for proper gray scales using the brightness and contrast controls in the prescribed manner. Both TV monitors were reinstalled on OV-099 and system performance during checkout was acceptable for flight. TV monitor performance during checkout was evaluated by the vendor and determined to be well within specification limits. CONCLUSION: Both TV monitors demonstrated acceptable performance and have been reinstalled on OV-099 for STS-7. CCTV system performance during checkout was acceptable for flight. The degraded contrast and fuzzy pictures experienced in flight on STS-6 could not be repeated during extensive tests at JSC and on OV-099. CORRECTIVE_ACTION: Both TV monitors were tested thoroughly at JSC and performance was evaluated by the vendor during CCTV checkout at KSC. No problem was identified.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-6-V-33	D&C
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: The HUD (Heads Up Display) Deceleration Scale Pointers Were Pegged. (ORB)

Summary: DISCUSSION: The crew reported that the deceleration display scale pointers on the HUD, both commanded and actual, did not respond during rollout. An evaluation of the software implementation showed that when the OPS-8 checkout was performed on-orbit, the I-load maximum deceleration command value was set to zero because of the test values used in the OPS-8 program. This value was maintained in the OPS-3 program and since the value is used in the denominator of the commanded and actual deceleration computations, both values were pegged during entry and rollout.

CONCLUSION: The problem was caused by a maximum deceleration command value being set at zero during on-orbit checkout and carried over into the entry program. CORRECTIVE_ACTION: A software change is being implemented which removes the OPS-8 maximum deceleration command value from the OPS-3 program. For STS-7 & 8 a patch will be incorporated in the flight software. A source update will be included in the software on STS-9 & subsequent missions.
EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation	Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-34	ECLSS
	GMT:		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Odor In Cabin Near MLR (Monodisperse Latex Reactor). (ORB)

Summary: DISCUSSION: The crew reported an odor near the MLR experiment on the second night of the flight. No trace of any offensive odors was noted during the KSC checkout. The crew did report that they were subjected to headaches during the flight, however, this phenomena has been experienced on previous space flights.

The MLR was removed and leak checked extensively with no sign of a leak or detectable odors. Both the support electronics package and the experiment apparatus container were sealed, leak tested with helium, and backfilled with nitrogen prior to flight. The experiment apparatus container holds four independant reactors with different samples in each. Postflight evaluation showed no evidence of leaking. Further, the inflight samples that were taken do not have the scent described by the crewmen. Outgassing toxicity tests have also been successfully completed on the MLR. Air samples taken during the flight did not have evidence of any of these compounds. A potential source of the odor, although not confirmed, was the burnt Kapton wire insulation from a short in a wire harness for the humidity separator. See problem STS-6-8. CONCLUSION: The odor had no discernable medical effect on the crew. The source of the odor in the cabin was not identified. CORRECTIVE_ACTION: Crews are being advised to take air samples in the areas of odors, should they become evident in subsequent flights. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-35		GN&C
	GMT:		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Rudder Pedal Deflection On Orbit Out Of Limit. (ORB)

Summary: DISCUSSION: OPS 8 checkout of the RPTA (Rudder Pedal Transducer Assembly) systems indicated a shift to the left for maximum rudder pedal deflection such that the FCS (Flight Control System) checkout limit (greater than 91 percent) was not quite obtainable on orbit. Postlanding troubleshooting indicated acceptable deflection results essentially identical to preflight results. Analysis of OV-102 data revealed similar shifting of the deflection capabilities, but just within the FCS on-orbit checkout limits. Structural/mechanical analysis revealed that the observed shifting is within normal bounds considering the tolerances of the pedal rigging and the structural bending which could be expected by the cabin in the zero external pressure environment present for the on-orbit FCS checkout. The on-orbit FCS checkout limits were specifically designed to be compatible with the entry RM limits, and did not take into consideration the potential structural bending shifts in the zero pressure environment. The entry FCS design provides adequate gains to allow full rudder authority for an 85 percent deflection input, so that even with the observed shifts, command capability for OV-099 is fully adequate.

CONCLUSION: The RPTA system on OV-099 (STS-6) operated normally, but on-orbit FCS checkout limits did not account for structural bending effects in zero pressure environments. CORRECTIVE_ACTION: The on-orbit FCS checkout requirements will be revised to account for the analytical/observed RPTA deflection characteristics. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-6-V-36	D&C
	GMT: Postlanding		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Panel F7 Caution And Warning Matrix Went Blank When Both Forward And Aft Caution And Warning READ Switches (C3 And R13) Were Activated At The Same Time. (ORB)

Summary: DISCUSSION: The crew reported that after getting a caution and warning alarm and "punching" it off, one of the crewmen used the caution and warning READ switch on panel C3 to call up the caution and warning light matrix on panel F7 to see what parameter(s) had caused the alarm. While he was reading the lighted matrix, a second crewman used the READ switch on panel R13 to see the same thing on the LED status matrix on that panel. At this time, the light matrix on F7 went blank, but the one on R13 remained lit.

KSC has recreated the scenario without being able to reproduce the anomaly. The caution and warning system is working properly. CONCLUSION: The cause of the reported anomaly is unknown. Analysis of the circuit shows that Memory Read A and Memory Read B are independent of each other. Since the memory read function is momentary; if the crewman relaxed his pressure on the switch handle, it could open the switch contact and turn off the light matrix. An alternate explanation is that the crewman inadvertently actuated the adjacent mode switch to acknowledge, which would remove power from the caution and warning annunciation. CORRECTIVE_ACTION: None. The system will be monitored for any recurrence. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-37	GN&C
	GMT:		**SPR** 06F022	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: IMU 3 BITE/T Message During Entry. (ORB)

Summary: DISCUSSION: After communications were re-established the IMU BITE/T message was noted to have occurred twice, one second apart, starting at

94:18:27:28. Postflight analysis indicated that the velocity limit fail flag was set for IMU 3. This IMU BITE/T message occurred near transition to major mode OPS 304.

Preflight and ascent analysis of data indicated that the IMU 3 Z accelerome had 5000 micro g noise. There is no accelerometer specification limit on noise. This noise level is not considered excessive although it is higher than experienced on other flight accelerometers. CONCLUSION: It is possible that the velocity under limit test was failed on IMU 3 during entry due to the Z accelerometer noise. A transient is also possible due to transition to major mode OPS 304. CORRECTIVE_ACTION: IMU 3 S/N 019 was replaced by S/N 001 IMU. S/N 019 IMU has been returned to the vendor for analysis. This problem will be tracked on CAR 06F022. CAR ANALYSIS: Cause of the noisy Z accelerometer was isolated to a defective U61 Shift Register (P/N A574A388-101) in the Gyro Accumulator Card (P/N A53A685, S/N 0021). [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-6-V-38		MECH
	GMT: Postlanding		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Right-hand Inboard Brake Stators Were Found Cracked After Postflight Disassembly. (ORB)

Summary: DISCUSSION: During postflight failure disassembly, a total of six cracks were found on three stators in the RHIB (right-hand inboard brake). All cracks were determined to have started in the "bottom" of the thermal expansion slots which are located around the O.D. (outer diameter) of each stator disc. The titanium spacers which fit into the elliptical enlargements in the bottoms of these slots were found to have been forced in rather than to fit loosely as required. This interference fit galls or scores the beryllium, initiating microcracks, which subsequently progress into large cracks during braking.

An undersized machining template caused the expansion slots in the STS-6 stator discs to be machined undersized. The titanium spacers were forced into place causing subsequent cracks which could have occurred during flight or even before brake delivery when the brake linings are "worn-in" at low energy levels. This problem could have been present on STS-5, however there is no way to prove that it caused the stator failure reported on problem STS-5-22A due to the massive destruction of the failed stator. CONCLUSION: The expansion slots in the STS-6 stator discs were machined undersized and the titanium spacers were forced into place causing subsequent cracks which could either have occurred during flight or even before brake delivery. The STS-6 brakes functioned satisfactorily. CORRECTIVE_ACTION: A completely new set of brakes was assembled and expedited for delivery on STS-7. The expansion slots for these brakes were remachined to meet the required clearance tolerances. The expansion slots on all subsequent brake assemblies will be remachined to the same tolerances. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET:	Problem	FIAR	IFA STS-6-V-39	Water and Waste
	GMT:		SPR	UA	Management System
			IPR	PR	Manager:
					Engineer:

Title: Possible Low Flow In Humidity Separator "A". (ORB)

Summary: DISCUSSION: The waste water quantity collected for the STS-6 mission was approximately 30 lbs below the predicted quantity, suggesting possible low performance of humidity separator "A". A postflight inspection of the lower equipment bay at EAFB and KSC did not indicate the presence of free water associated with water carryover in the humidity separator. An airflow check was conducted on the slurper/humidity separator "A" combination at KSC, and the air flowrate was 25.65 lbs/hr, indicating restricted flow in either the slurper or humidity separator package. After repair of the separator "B" wire bundle (see problem 6-8), reverse flow blowdown of the cabin heat exchanger slurper was performed and the corresponding air flowrates were 46 lbs/hr and 44 lbs/hr for separators A and B, respectively.

CONCLUSION: Postflight inspection for free water in the lower equipment bay did not conclude that water carryover had occurred in humidity separator "A". CORRECTIVE_ACTION: A reverse flow procedure was performed on the slurper and above specification flowrates were obtained for both separators. An inflight inspection of the lower equipment bay for the presence of free water will be performed during STS-7. An assessment of the predicted water production rates for past mission is currently being evaluated and will be reassessed during STS-7. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	MET: Postlanding	Problem	FIAR	IFA STS-6-V-40	Water and Waste
	GMT: Postlanding		SPR	UA	Management System
			IPR	PR	Manager:
					Engineer:

Title: Waste Collection System (WCS) Fan Separator 1 Made An Unusual Noise And Varied In Speed. (ORB)

Summary: DISCUSSION: The crew reported that WCS fan separator 1 was making an unusual noise and it varied in speed throughout the flight. Fan separator 1 continued to operate normally and the redundant fan separator 2 was operated. Postflight, KSC personnel operated the fan separators and observed that fan separator 1 varied in speed and exhibited a vibration noise.

CONCLUSION: The cause of the noise and vibration will be determined during investigation at the vendor. CORRECTIVE_ACTION: Fan separator 1 will be removed and sent to the WCS vendor for investigation. The OV-102 WCS flown on STS-6 has been replaced with the OV-099 WCS. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:** Postlanding	Problem	**FIAR**	**IFA** STS-6-V-41	Water and Waste
	GMT: Postlanding		**SPR** 06F020	**UA**	Management System
			IPR	**PR**	**Manager:**
					Engineer:

Title: Water Tank D Brazed Fitting On Outlet Valve Leaked. (ORB)

Summary: DISCUSSION: After STS-6, water was discovered to be leaking from potable water tank D outlet valve. KSC reported that water was leaking from tank D outlet valve at 2 drops per minute. This problem was not noticed in flight because the leak rate was so low several days would have been required to make a noticeable effect on tank D quantity indication. The valve was removed and found to have a crack along the outlet fitting. Failure analysis revealed that the stainless steel valve material had a flaw area of carbon steel.

CONCLUSION: Corrosion in potable water tank D outlet valve caused the leak to develop in the area of a material flaw of carbon steel. CORRECTIVE_ACTION: A replacement valve has been installed on OV-099. Tank quantities will be monitored on OV-099 prior to STS-7 to verify no further leakage. Similar valves on OV-102 and OV-103 and spares will be tested with an eddy current technique to check for similar problems. The valves on OV-099 will be tested after STS-7. This problem will be tracked on CAR 06F020. CAR ANALYSIS: Lab analysis of the defective unit revealed the leakage was caused by contamination within the basic forging material in the form of an inclusion (carbon or low alloy steel), which by corrosion developed into a longitudiual crack through the entire forging. Source of the contamination is unknown, but was most likely introduced during the material rolling or forging operations. The condition is considered an isolated case involving a rare type of contamination which will corrode in the presence of water. The contamination will destroy passivation in the 304L material and result in a slow growth of the corrosion. [not included in original problem report] EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification	Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-42	ECLSS
	GMT:		**SPR**	**UA**	**Manager:**
			IPR	**PR**	
					Engineer:

Title: Gas Was Noticed In The Potable Water During The Mission. (ORB)

Summary: DISCUSSION: The crew reported that there were excessive amounts of gas present in the potable water throughout the mission. One mission specialist was unable to get water from the EMU drink bag during the EVA, possibly because of gas in the water. A sample of water taken postflight did not contain dissolved gas. Prior to STS-6, tank A passed the required compressibility test. Subsequent to the compressibility test, a fuel cell was replaced.

CONCLUSION: The fuel cell changeout may have introduced gas into the potable water system CORRECTIVE_ACTION: For STS-7, tank A was emptied and vacuum filled. Water was flushed through the system to remove free gas. A compressibility test was conducted and passe the OMRSD requirement. A water sample was taken and had no free gas. A change will be made to the OMRSD, requiring a vacuum fill each time the system is opened for maintenance or fuel cell replacement. EFFECTS_ON_SUBSEQUENT_MISSIONS: None.

Tracking No	Time	Classification		Documentation		Subsystem
MER - 0	**MET:**	Problem	**FIAR**	**IFA** STS-6-V-43		PYLD
	GMT:		**SPR**	**UA**		**Manager:**
			IPR	**PR**		
						Engineer:

Title: Payload Interrogator Lost Lock After Inertial Upper Stage Deployment. (ORB)

Summary: DISCUSSION: Shortly after IUS (Inertial Upper Stage) deployment, the PI (Payload Interrogator) lost lock and a lock to a signal offset from the center frequency occurred. Postflight analysis indicated that during the IUS elevations and deployment, the received signal strength fluctuated. The most probable cause of the loss of lock is the irregularity of the RF signals associated with motion of the IUS in and near the Orbiter payload bay. The IUS transponder had been in a ranging mode which produced IUS transmitter side bands of sufficient amplitude to cause the PI receiver to lock to them. The known frequency of the side bands is within the telemetry measurement accuracy of the PI offset.

CONCLUSION: Motion of the IUS in and near the Orbiter payload resulted in signal strength variations which caused the PI to lose lock. The PI then locked to an IUS-ranging side band frequency. CORRECTIVE_ACTION: 1. The IUS transponder operation is being modified by the Air Force to insure that the ranging function is not enabled until IUS/PI operation is completed. 2. The crew procedures have been modified such that if an offset-lock occurs, the crew will first sweep the PI transmit frequency in an attempt to break lock. If this does not work, the crew will then cycle power on the PI, and if the offset-lock condition still exists, they will switch to the other PI. In the event that the data link is not recovered, the current mission rules state that no failure of the PI will cause termination of IUS operations. EFFECTS_ON_SUBSEQUENT_MISSIONS: NONE